

**Claims**

1. High-viscous moulding materials which are suitable for the extrusion blow moulding process and based on thermoplastic polymers selected from the group consisting of polyamides, polyesters, polyether esters, polyester amides or mixtures thereof, having increased melt strength, characterized in that they contain in combination:
  - (a) nano-scale fillers in an amount of from 0.5 to 15 wt.-% per 100 parts by weight of the polymer matrix
  - (b) fibrous filling agents in amounts of from 5-30 wt.-% per 100 parts by weight of the polymer matrix and
  - (c) impact modifiers in amounts of from 3-12 wt.-% per 100 parts by weight of the polymer matrix, and if required further additives (d), wherein the moulding materials have a melt strength being about at least 30 % higher than that of similar moulding materials comprising instead of the nano-scale fillers (a) merely usual mineral filler materials.
2. Moulding materials according to claim 1, characterized in that the nano-scale fillers (a) are comprised in an amount of from 2-10 wt.-% per 100 parts by weight of the polymer matrix in the moulding materials.
3. Moulding materials according to claim 1 or 2, characterized in that the nano-scale fillers (a) are comprised in an amount of from 4-6 wt.-% per 100 parts by weight of the polymer matrix in the moulding materials.
4. Moulding materials according to any one of claims 1 to 3, characterized in that the fibrous filling agents (b) are comprised in amounts of from 5-20 wt.-% per 100 parts by weight of the polymer matrix in the moulding materials.
5. Moulding materials according to any one of claims 1 to 4, characterized in that the fibrous filling agents (b) are comprised in amounts of from 5-15 wt.-% per 100 parts by weight in the moulding materials.
6. Moulding materials according to any one of claims 1 to 5, characterized in that polyamides or polyesters are used as thermoplastic polymers, wherein polyethylene terephthalate or polybutylene terephthalate is especially preferred as polyester.

7. Moulding materials according to any one of claims 1 to 6, characterized in that the nano-scale fillers are selected from the group of the metals or semi-metals or oxides or oxide hydrates.
- 5 8. Moulding materials according to claim 7, characterized in that the nano-scale fillers are selected from the group of the oxides and oxide hydrates of an element selected from the group of boron, aluminium, magnesium, calcium, gallium, indium, silicon, germanium, tin, titanium, zirconium, zinc, yttrium, iron or talc.
- 10 9. Moulding materials according to claim 8, characterized in that the nano-scale fillers are selected from silicon dioxide and silicon dioxide hydrates.
- 15 10. Moulding materials according to any one of claims 1 to 9, characterized in that the polyamide moulding material in the polyamide matrix comprises a uniformly dispersed, layered mineral as filler having a layer thickness of 0.7 to 1.2 nm and an interlayer separation of the mineral layers of up to 5 nm prior to being incorporated in the polyamide matrix.
- 20 11. Moulding materials according to any one of preceding claims 1 to 10, characterized in that the mineral uniformly dispersed in the polymer matrix has a cation exchange capacity of from 0.5 to 2 meq/g mineral, especially of from 0.7 to 0.8 meq/g mineral.
- 25 12. Moulding materials according to any one of preceding claims 1 to 11, characterized in that the mineral is treated by an activating or modifying agent from the group of the triazines, the ammonium salts of primary amines having at least 6 carbon atoms such as hexane amine, decane amine, dodecane amine, stearyl amine, hydrated fatty acid amines or quarternary ammonium compounds, ammonium salts of  $\alpha$ -, $\omega$ -amino acids having at least 6 carbon atoms and sulfonium or phosphonium salts.
- 30 13. Moulding materials according to any one of claims 1 to 12, characterized in that the nano-scale fillers are layered silicates from the group of montmorillonite, saponite, beidellite, nontronite, hectorite, stevensite, vermiculite, illite, pyrosite, the group of the kaoline and serpentine minerals, double hydroxides, graphite, or such fillers on basis of silicones, silica or silsesquioxanes, wherein layered silicates are especially preferred.
- 35 14. Moulding materials according to any one of preceding claims 1 to 13, characterized in that the mineral is treated by an adhesion promoter and the adhesion promoter is

comprised in an amount of up to 2 wt.-% in the moulding material per 100 parts by weight of the polymer matrix.

15. Moulding materials according to any one of preceding claims 1 to 11, characterized in that the (co)polyamides are polymerides of aliphatic C<sub>6</sub>-C<sub>12</sub> lactams or  $\omega$ -amino acids having 4 to 44 carbon atoms, preferably 4 to 18 carbon atoms, or copolymers, obtainable from the polycondensation of at least one diamine from the group of the aliphatic diamines having 4 to 12 C atoms, the cycloaliphatic diamines having 7 to 22 C atoms and the aromatic diamines having 6 to 22 C atoms in combination with at least one dicarboxylic acid from the group of aliphatic dicarboxylic acids having 4 to 12 C atoms, cycloaliphatic dicarboxylic acids having 8 to 24 C atoms and aromatic dicarboxylic acids having 8 to 20 C atoms, wherein also blends of the afore-mentioned polymerides and/or polycondensates are suitable.  
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- 15 16. Moulding materials according to claim 15, characterized in that the  $\omega$ -amino acids and the lactams are selected from the group of  $\epsilon$ -aminocaproic acid, 11-aminoundecanoic acid, 12-aminododecanoic acid,  $\epsilon$ -caprolactam, enanthlactam,  $\omega$ -laurinlactam.  
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- 15 17. Moulding materials according to claim 15, characterized in that the diamines are selected from the group of 2,2,4- or 2,4,4-trimethylhexamethylenediamin, 1,3- or 1,4-bis(aminomethyl)cyclohexane, bis(p-aminocyclohexyl)methane, m- or p-xylylenediamine, 1,4-diaminobutane, 1,6-diaminohexane, 1,10-diaminodecane, 1,12-diaminododecane, cyclohexyldimethyleneamine, and the dicarboxylic acids are selected from the group of succinic acid, glutaric acid, adipic acid, suberic acid, pimelic acid, suberic acid, azelaic acid, sebacic acid, dodecanedicarboxylic acid, 1,6-cyclohexanedicarboxylic acid, terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid.  
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18. Moulding materials according to any one of claims 1 to 6 or 15 to 17, characterized in that the polyamides are homopolyamides or copolyamides or amorphous polyamides selected from the group of polyamide 6, polyamide 46, polyamide 6 6, polyamide 11, polyamide 12, polyamide 12 12, polyamide 6 10, polyamide 6 12, polyamide 6 9, polyamide 12 T, polyamide 10 T, polyamide 12 I, polyamide 12 T/12, polyamide 10 T/12, polyamide 12 T/10 6, polyamide 10 T/10 6, polyamide 6/6 6, polyamide 6/6 12, polyamide 6/6 6/6 10, polyamide 6/6 6/12, polyamide 6/6 T, polyamide 6/6 I, polyamide 6T/66, polyamide 12/MACMI, polyamide 66/6I/6T, polyamide MXD6/6 or mixtures, blends or alloys thereof.  
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19. Moulding materials according to any one of claims 1-18, characterized in that further polymers from the group of the polyesters, polyolefins, polycarbonates, polyethylene vinyl alcohols are added in amounts of up to 30 wt.-% to the moulding materials.
- 5 20. Moulding materials according to any one of claims 1-19, characterized in that further additives (d) from the group of the UV and heat stabilizers, the antioxidant agents, the pigments, dyes, nucleation agents, crystallization accelerators, crystallization retardants, flow assistants, lubricants, release agents, flame retardants, as well as agents improving 10 the electrical conductivity are added to the moulding materials.
- 10 21. Moulding materials according to any one of claims 1-20, characterized in that the fibrous filling agents are glass fibers, especially E glass fibers.
- 15 22. Moulding materials according to any one of preceding claims 1-21, characterized in that such impact modifiers on basis of polyolefins being grafted by acrylic acid and maleic anhydride, especially ethylene-propylene rubbers (EPM), ethylene-propylene-diene rubbers (EPDM) or acrylate rubbers, are added to the polyamide moulding materials as impact modifiers.
- 20 23. A method for producing the moulding materials according to any one of claims 1-22, characterized in that the production of moulding materials is performed by melting the polymers and then compounding the nano-scale fillers (a), the fibrous filling agents (b) and the impact modifiers (c) by an extrusion method.
- 25 24. The method according to claim 23, characterized in that the moulding materials are produced in a double screw extruder at temperatures of between 240 °C and 350 °C.
- 30 25. The method for producing moulding materials according to any one of claims 1-22, being performed by melt intercalation, wherein the thermoplastic, the nano-scale fillers, the fibrous filling agents (b), the impact modifiers (c), and if required the further additives (d) are mixed at temperatures in the range of from 160-350°C and up to 30 wt.-% of a liquid, especially water, is injected into the melt.
- 35 26. Use of the moulding materials according to any one of claims 1-25 for the production of moulded articles, hollow bodies, semi-finished products, plates, pipes.

27. Use according to claim 26, characterized in that the hollow bodies are bottles.
28. Moulded article, obtainable using moulding materials according to any one of claims 1-22.
- 5 29. Method for producing moulded articles according to claim 27 in one or more steps by coextrusion, extrusion blow moulding, compression moulding or sheeting methods.